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1 OF 2

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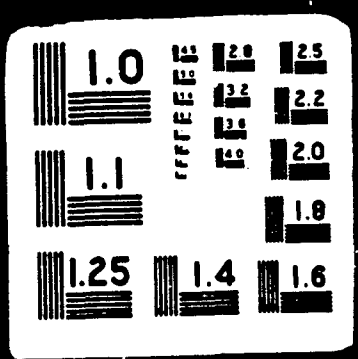

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AA 61-0124
18 September 1961

WS 107A-1 FLIGHT TEST WORKING GROUP

FLIGHT TEST REPORT

ATLAS MISSILE 26E

8 September 1961

Log No. T 61-2709 Copy No. 51

AMR RANGE TEST NUMBER 1803

ASTRONAUTICS TEST NUMBER P3-501-00-26

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ERRATA

Flight Test Report 26E

Please change page 2, Flight Test Objectives nos. 2 and 7 from "No" to "Part".

H. C. O'Dell

H. C. O'Dell, Supervisor
Data and Weights

(9-59)

FOREWORD

This report has been prepared to present preliminary information relative to the flight of Atlas Missile No. 26E. The information presented is based on visual observation and data evaluation to the extent permitted by time limitations. It should be considered as preliminary only, and the final reports on this flight referenced for further information. The technical content has been prepared and jointly agreed upon by members of the WS 107A-1 Flight Test Working Group.

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Form 972-A (3-59)

SUMMARY

Atlas Missile 26E, the twelfth "E" Series missile to be flight tested, was launched from AMR, Complex 13 at 2042 EST on 8 September 1961. The planned range for the Mark 4 Mod 2A Re-entry Vehicle was 4388 nautical miles with impact in the Ascension Island splash net. The flight was unsuccessful and impact was approximately 575 nautical miles downrange.

The flight was prematurely terminated when the sustainer engine shut down during the booster jettison sequence. Engine operation was satisfactory until the beginning of the normal telemetry data dropout always observed during the booster jettison sequence. When data was again available, the sustainer engine had already shut down. The cause of engine shutdown has not been determined.

Operation of all other systems was satisfactory.

TABLE OF CONTENTS

FLIGHT TEST OBJECTIVES

The primary purposes of this flight were to obtain data for statistical determination of CEP, evaluate the performance of the Accustica PU System and to determine Re-entry Vehicle structural capabilities at high angle re-entry conditions.

Detailed objectives are listed on the following pages along with applicable comments relative to the degree of satisfaction.

OBJECTIVES	ORDER	YES	NO	PART	COMMENT
1 - First Order					
2 - Second Order					
3.- Third Order					
Weapon System Objectives					
1. Obtain data on repeatability of all airborne and ground systems.	2			X	
2. Evaluate ARMA Inertial Guidance System performance and accuracy.	1		■	X	
3. Evaluate Flight Control System performance.	2			X	
4. Evaluate the performance of the Acoustica PU System.	1			X	
5. Determine Re-entry Vehicle structural capabilities at high angle re-entry conditions (loading).	1		X		
6. Determine performance of Re-entry Vehicle throughout re-entry flight (heating, ablation, stability) and separation system performance.	2		X		
7. Evaluate Re-entry Vehicle Arming and Fusing System at high angle re-entry conditions (airburst and impact fusing).	1		■	X	
8. Obtain Data on Re-entry Vehicle impact location for statistical determination of CEP.	1		X		

OBJECTIVES	ORDER	YES	NO	PART	COMMENT
9. Evaluate performance of Sandia Warhead System.	1		X		
10. Obtain Data on lateral drift during liftoff.	3	X			
Non Weapon System Objectives					
1. Obtain Data on AFSWC Pod experiment.	3		X		

FLIGHT TRAJECTORY

The flight of Atlas Missile 26E was planned for a range of 4,388 nautical miles, with impact in the Ascension Island splash net. This range was not achieved. The flight was terminated prematurely due to difficulty associated with the sustainer engine system during the booster jettison sequence. The trajectory during booster phase of flight appeared to be very close to nominal as indicated by tracking data and radar plots. Impact was approximately 575 nautical miles downrange.

SYSTEM PERFORMANCE

AIRFRAME

Missile structural integrity was satisfactorily maintained throughout powered flight. Due to a Propulsion System malfunction the missile began tumbling shortly after booster cutoff. Several areas of the missile structure were instrumented for temperature environment. This instrumentation is discussed in the following paragraphs.

The two temperature measurements in the thrust section both indicated temperature rise in the engine compartment. Measurement P 671 T , Thrust Section Ambient - Quadrant 4, was essentially steady at 105°F until 98 seconds and then rose to a temperature of 141°F at 116 seconds. After a slight decline lasting through the staging sequence, the temperature increased rapidly to 168°F at 134 seconds. After this time the measurement varied between 89°F and 201°F for the remainder of the flight.

Measurement A 638 T, Aft Side A Frame Quadrant 2, began a rise from 108°F at 80 seconds to 187°F at 119 seconds. This measurement then showed a steady decline to a temperature of 108°F at 296 seconds.

Two measurements, A 446 T and A 479 T, were provided for ambient temperature indications in the adapter and B1 pod areas. A 446 T, Cableway Fairing compartment ambient, showed a gradual climb to a temperature of 51°F at 115 seconds and then indicated a gradual decline. Measurement A 479 T, Adapter Section Ambient, indicated a steady increase to 146°F at booster cutoff.

The peak temperatures, time from range zero, and location of measurements A 51 T thru A 55 T, which were located on the missile tank near the AFSWC pod are tabulated in the following table.

	MAXIMUM TEMPERATURE		
MEASUREMENT	Value in °F	Time in Seconds From Range Zero	STATION
A 51 T	112°	114	963
A 52 T	132°	125	973
A 53 T	103°	125	989
A 54 T	74°	125	1009
A 55 T	103°	125	1028

All of these measurements exhibited the same general characteristics of rising to a maximum temperature and then starting a decline to essentially a continuous steady indication.

PROPULSION SYSTEM

Performance of the booster system was satisfactory in all respects. Sustainer and vernier performance was satisfactory throughout the booster phase and until booster jettison. During the booster jettison sequence sustainer engine performance was prematurely terminated. Following sustainer engine shutdown the vernier engines switched to tank fed operation and ran for 28 seconds until propellant depletion. The cause of the sustainer shutdown has not been determined.

Sustainer engine shutdown was initiated during a period of data loss at booster jettison. This data loss is a normal occurrence and is caused when the sustaine flame impingement on the booster section creates a telemetry radiation barrier.

Telemetry tapes from Stations 1, 3, and 5 were reviewed and some additional data points were provided from the Station 3 tape during the data dropout. The latest time that data was available prior to the dropout was 128.79 seconds and the earliest time data was available after the dropout was 129.07 seconds.

Prior to the dropout, data indicated normal sustainer system operation. A time comparison with previous "E" Series jettison data indicates the booster section had just completely cleared the jettison rails at the time the dropout started. Data received after the dropout indicated sustainer engine termination had been accompanied by a LO2 rich shutdown of the sustainer gas generator, the HS valve moving to the full open limit, and the PU and sustainer gas generator valves going full closed. The most significant datum was the indication of the extremely high gas generator gas temperature which was greater than 1510° immediately after the data dropout. This high temperature condition can only result from a drop in fuel flow or an increase in LO2 flow to the gas generator. Considering the nature of the shutdown, the manner in which the Propulsion System operates, and the limited data available, the most probable cause of the high gas generator temperature and of engine shutdown was a drop in fuel flow to the gas generator.

Trailing wire umbilical instrumentation of propulsion parameters was available for 2.66 seconds after One Inch Motion or for approximately 50 feet of missile rise. Ten of eleven propulsion measurements recorded provided satisfactory data. The measurement which was invalid was P 1003 P, B2 LO2 Pump Inlet Pressure. Measurements of the B1 and B2 LO2 and Fuel Injection Manifold and Pump Inlet Pressures appeared normal. There were three LO2 Dome Accelerometers monitored. Measurement P 1206 O, Sustainer Engine LO2 Dome, indicated a varying level between 2 and 7 G's RMS after the start transient. This measurement also indicated bursts of approximately 20 G's RMS during engine start. Measurements P 1208 O, B1 LO2 Dome, and P 1209 O, B2 LO2 Dome, indicated varying levels between 5 and 15 G's RMS.

Values from landline and telemetry records are presented on the following pages.

PROPULSION SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	Expected Values	L/L at Liftoff	After Liftoff	Prior to BCQ
Booster Engines						
P 155 P	B1GG Combustor	psia	477	-	460	480
P 184 P	B2GG Combustor	psia	477	-	480	480
P 173 T	B1 GG Combustor Temp	dgf	1180	-	1030	1070
P 714 T	B2GG Combustor Temp	dgf	1180	-	1060	1120
P 473 P	B1 Lo Pr Lube Oil Man	psia	110	-	142	142
P 279 P	B2 Lo Pr Lube Oil Man	psia	110	-	122	115
P 1001 P	B1 LO2 Pump Inlet	psia	-	79	-	-
P 1003 P	B2 LO2 Pump Inlet	psia	-	*	-	-
P 1020 T	B1 LO2 Pump Inlet Temp	dgf	-	-288	-	-
P 1054 T	B2 LO2 Pump Inlet Temp	dgf	-	-286	-	-
P 1002 P	B1 Fuel Pump Inlet	psia	-	78	-	-
P 1004 P	B2 Fuel Pump Inlet	psia	-	79	-	-
P 84 B	B1 Pump Speed	rpm	6166	-	6160	6240
P 83 B	B2 Pump Speed	rpm	6166	-	6250	6360
P 1093 P	B1 Fuel Inj Man	psia	-	712	-	-
P 39 P	B1 Fuel Pump Disch	psia	836	-	*	*

PROPULSION SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	Expected Values	L/L at Liftoff	After Liftoff	Prior to BCO
P 1094 P	B2 Fuel Inj Man	psia	-	726	-	-
P 38 P	B2 Fuel Pump Disch	psia	836	-	820	840
P 91 P	B1 LO2 Inj Man	psia	677	674	690	710
P 92 P	B2 LO2 Inj Man	psia	677	690	680	690
P 60 P	B1 Thrust Chm	psia	577	-	560	584
P 59 P	B2 Thrust Chm	psia	577	-	568	592
P 1711 T	B1 Nacelle Ambient	dgf	-	66	-	-
P 1712 T	B2 Nacelle Ambient	dgf	-	78	-	-
Sustainer Engines						
P 337 P	SGG LO2 Inj Man	psia	861	-	840	820
P 709 T	SGG Combustor Temp	dgf	1060	-	1160	1015
P 341 P	S Lube Oil Man	psia	625	-	660	630
P 56 P	S LO2 Pump Inlet	psia	-	-	72	105
P 530 T	S LO2 Pump Inlet Temp	dgf	-293	-	-292	-287
P 349 B	Sus Pump Speed	rpm	9950	-	10190	10140
P 529 D	S Main LO2 Valve	deg	-	-	35	39
P 528 D	S Main Fuel Valve	deg	-	-	21.3	23.0

PROPULSION TIME SLICE DATA

Measurement No.	Description	Units	Expected Values	L/L at Liftoff	After Liftoff	Prior to BCO
P 330 P	S Fuel Pump Disch	psia	1000	-	930	945
P 351 P	S LO2 Inj Man	psia	806	-	810	800
P 6 P	S Thrust Chamber	psia	693	-	680	680
P 1718 T	S Eng Environment	dgf	-	83	-	-
Vernier Engines						
P 1474 P	Vern CH Press Reg Out	psia	-	595	-	-
P 30 P	Vernier LO2 Tank	psia	651/600	-	50	60
P 27 P	Vernier Fuel Tank	psia	662/600	-	120	680
P 28 P	V1 Thrust Chamber	psia	340/300	-	330	330
P 29 P	V2 Thrust Chamber	psia	340/300	-	330	330
Miscellaneous						
P 1325 T	Eng Comb Amb	dgf	-	91	-	-
P 671 T	Thrust Section Ambient	dgf	-	-	88	124

* Instrumentation Malfunction

PNEUMATIC SYSTEM

Performance of the Pneumatic System was satisfactory. LO2 tank pressure Measurement F 1 P was invalid. There were no indications of abnormal system performance before or coincident with the premature sustainer engine shutdown.

Missile 26E was equipped with F and G Pneumatic Regulators, a GD/A Poppet E Series Boiloff Valve, and Hadley LO2 and Fuel Tank Airborne Relief Valves.

Tank Pressurization System

Although Measurement F 1 P, LO2 Tank Helium, was invalid during the flight, the corresponding landline measurement indicated 24.9 psig prior to liftoff. Measurement P 56 P, Sustainer LO2 Pump Inlet, indicated normal pressure at the pump inlet, reflecting normal LO2 tank pressure during booster phase. Fuel tank pressure was normal from liftoff to booster jettison. Fuel consumption was reduced to zero coincident with sustainer engine shutdown at booster jettison, with tank helium pressure remaining about 63 psia until the end of available data at 307 seconds. Booster tank helium bottles pressure decay was normal with 730 psia at BCO.

Five vibration measurements were made in the area of the LO2 tank pneumatic regulator to obtain in-flight data of vibrational input at the regulator mounting base and on the regulator itself. These measurement were:

A 781 O	LO2 Tank Pressure Regulator Base, Radial
A 782 O	LO2 Tank Pressure Regulator Base, Longitudinal
A 783 O	LO2 Tank Pressure Regulator Base, Tangential
A 784 O	LO2 Tank Pressure Regulator, Radial
A 785 O	LO2 Tank Pressure Regulator, Tangential

High frequency vibratory response of the regulator until jettison with the booster section appeared normal. The greatest response occurred between 60 and 70 seconds. The levels observed on the regulator ranged between 2 and 5 G's RMS. A maximum of 10 G's RMS was observed during this time on the regulator base.

Engine Control Pressurization System

Sustainer engine control helium bottle pressure was adequate for booster separation purposes. Abnormal bottle pressure depletion occurred after the premature sustainer engine shutdown. Since no vernier cutoff signal was generated, the vernier propellant valves were not closed and the helium in the propellant tanks was vented to the atmosphere through the vernier engines. Consequently the control bottle was depleted from a normal value of 2910 psia at 130 seconds to 380 psia by 170 seconds.

PNEUMATIC SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	Landline	/5 After Liftoff	/125 Prior to BCO
F 1001 P	LO2 Tank Helium	psia	39.6	*	*
F 1003 P	Fuel Tank Helium	psia	74.5	76.5	63.5
F 1246 P	B Tank He Bottles Hi	psia	2967	2710	730
F 247 T	B Tank He Bottles	dgf	-	*	*
F 115 T	LO2 Press Reg Inlet	dgf	-	183	376
F 1145 P	S Ctl He Bottle Disch	psia	2948	2910	2910

* Instrumentation Malfunction

HYDRAULIC SYSTEMS

Performance of the Hydraulic Systems was satisfactory. System pressures rose from ground levels of about 2000 psia to about 3000 psia after liftoff and remained at normal levels until staging.

Performance of the Booster Hydraulic System was satisfactory. Telemetered data reflected normal system pressure for actuation of the booster engines during booster phase operation.

Performance of the Sustainer/Vernier Hydraulic System was satisfactory until staging. Measurements H 130 P, Sustainer Hydraulic Pump Discharge, and H 191 P Sustainer High Pressure to Manifold, indicated abrupt decay of discharge pressure from 3000 psia to 100 psia at staging as a result of sustainer engine shutdown.

The Vernier Solo Accumulator satisfactorily maintained vernier engine actuator pressure after sustainer shutdown for 41 seconds, bottoming out at that time at 870 psia.

MISSILE ELECTRICAL SYSTEM

Performance of the Missile Electrical System was satisfactory. System parameters remained within specifications until well beyond sustainer engine shutdown. Main missile battery voltage remained between 27.3 and 28.6 vdc. Inverter frequency was virtually constant at 401.2 cps. Inverter Phase A and Phase C voltages were between 113.8 and 115.0 vac and 114.4 and 115.3 vac, respectively. The Phase A and Phase C voltage data were reasonably steady during booster phase. After sustainer shutdown, the data became somewhat erratic. However, the data remained within the above stated ranges.

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OPTICAL BEACON SYSTEM

The Optical Beacon System activated properly at 317.328 seconds upon receipt of a sustainer engine cutoff discrete signal. Telemetry Channel 1-C switched to monitor the Optical Beacon System satisfactorily. The first pulse occurred at 318.037 seconds. Telemetered data indicate that 18 correctly spaced pulses were generated by the Optical Beacon System. The last correctly spaced pulse occurred at 326.537 seconds. The pulses occurring after this time were erratic and randomly spaced. Thirty-eight more pulses were recorded after the last correctly spaced pulse. The last pulse occurred at approximately 331 seconds.

Preliminary evaluation of the Ballistic Camera (BC-4) coverage indicates that very little, if any, trajectory information was obtained. If any trajectory information was recorded by the BC-4 cameras and/or photo multipliers, a more thorough investigation will be required to determine the value and usefulness of these data.

RANGE SAFETY COMMAND SYSTEM

Performance of the Range Safety Command System was satisfactory. No signals were generated by the Range Safety Command System. However, signal strength at the missileborne receivers was adequate to ensure proper system operation had any signals been transmitted.

AZUSA SYSTEM

Performance of the Azusa System was satisfactory. Telemetered r-f input/ AGC and ground station received signal strength AGC both indicated considerable multi-path reception and lobing until 70 seconds. After that time signal strength was smooth and adequately high until approximately 142 seconds. At that time the signal strength began to drop off and the AGC traces thereafter indicated missile tumbling.

The system, which utilized a B1 transponder in conjunction with a tripod mounted eliptical horn antenna mounted in Quad IV, acquired automatic track at 12.5 seconds. All parameters were in the fine mode by 18 seconds and no ambiguities entered until signal was lost. Data were reducible from 17.3 seconds until 151.9 seconds.

The Automatic Data Select System at the 7090 Computer selected Azusa System data many times for very short periods. The most extended periods were between 86.4 and 95.2 seconds, between 118.4 and 128.8 seconds, and between 130.8 and 154.0 seconds.

FLIGHT CONTROL SYSTEM

Performance of the Flight Control System was satisfactory. Response to the guidance roll maneuver was satisfactory and the pitch program was properly accomplished. There was no bending mode buildup and propellant slosh was small. All programmer switching functions occurred properly. Missile pitch and yaw stability was lost after staging as a function of sustainer hydraulic pressure decay resulting from sustainer shutdown. Roll stability was maintained by the vernier engines until loss of adequate vernier hydraulic accumulator pressure at 167 seconds. Engine deflections at engine start were within the allowable tolerance of $\pm$0.6 degrees. Liftoff and staging transients appeared normal.

Sustainer and vernier cutoff discretes were generated by the Guidance System at 317 seconds for an unknown reason. Response to these discretes by the programmer was proper and the pre-arm backup, re-entry vehicle separation, and fire retro-rockets functions were subsequently issued at the proper times. A short at the time of retro-rockets firing caused the programmer switch current limiter to open in 0.66 seconds, and, therefore, Measurement S 379 X, Fire Retro-Rockets, did not activate. Drops in the programmer voltage output at 0.2 seconds after the pre-arm backup function indicated a low impedence loading of the circuit. Measurement S 223 D, V2 Pitch Engine Position, was inoperative prior to countdown start and the measurement was deleted.

This was the first "E" Series missile to utilize the Spin Motor Rotation Detector System which was previously flown on Missile 2F. The gyro spin motor rotation detector output remained activated throughout the flight as expected.

INERTIAL GUIDANCE SYSTEM

Performance of the Inertial Guidance System was satisfactory. The roll maneuver was generated satisfactorily and the staging discrete was issued at the proper time. The criteria for the three remaining discretes were not properly satisfied due to premature sustainer engine shutdown. However, two of the discretes, SCO and VCO, were generated simultaneously at approximately 317 seconds. The cause of this discrepancy has not been determined, but was probably associated with missile tumbling. The pre-arm discrete was inhibited due to the excessive missile angular displacement which occurred after loss of attitude stability. At guidance steering enable, the pitch resolver signal data indicated that the missile had pitched to approximately 1.5 degrees beyond the nominal resolver setting of 61.7 degrees. At this time a large yaw left steering command was also being generated. The missile did not respond to either of these guidance commands due to loss of sustainer thrust.

Target offsets of -0.0061 degrees latitude and ∮0.0016 degrees longitude were inserted in the Inertial Guidance System to compensate for re-entry vehicle parameters and vernier thrust decay.

Inertial Mode Start occurred at 2042:20.929 EST.

System Accuracy

Accuracy evaluation was limited due to early termination of the flight. Comparison of telemetered ARMA velocities with GE/Burroughs Mod III velocities at staging indicated velocity errors of:

$\dot{X}$	-1.76 ft/sec
$\dot{Y}$	∮2.06 ft/sec
$\dot{Z}$	∮3.42 ft/sec

These small errors indicated satisfactory operation and accuracy during the powered portion of the flight.

Missile Behavior

A comparison of the telemetered velocities and positions with those listed in Trajectory E-XII at the approximate time of staging was as follows:

Function	Units	Actual	Nominal	Difference*	3 Sigma Limits
Time	sec	125.00	125.25	-0.25	±6.5
$\dot{X}$	ft/sec	9324.25	9317.25	+7.00	±70
$\dot{Y}$	ft/sec	432.0	477.50	-45.5	±600
$\dot{Z}$	ft/sec	4163.25	4256.00	-92.75	±900
X	ft	429,824	432,512	-2,688	±19,500
Y	ft	52,544	55,168	-2,624	±25,500
Z	ft	203,200	206,464	-3,264	±28,500
CEF	rad	-0.002288	-0.00038	-0.001908	-
REF	rad	4.151854	4.1226	+0.029254	-

* Actual minus nominal

The missile went out of control at 129 seconds and the platform tumbled at 162 seconds. The Guidance System operation was normal through this period and until 317 seconds. At 317 seconds, the computer issued SCO and VCO although the necessary velocities for these discretes had not been attained. The cause of this discrepancy could have been internal or external to the Guidance System and a resolution has not been made at this time.

Platform and Control

The roll maneuver, as indicated by the azimuth resolver, was executed properly during the 2 to 19 second period.

The pitch resolver came into the instrumented range at 97 seconds.

All servo errors were normal and less than ± 1 minute deviation.

Gyro drifts measured prior to launch were:

Gross Azimuth	-0.33 deg/hr	Pre-countdown
Roll Fixed	-0.13 deg/hr	X-1 Day
Gross Pitch	-0.24 deg/hr	X-1 Day

These values were consistent with previous measurements. Redundant gyro torquing currents were normal. Maximum amplitude oscillations occurred at 90 seconds and were 70 deg per hour peak to peak.

Gyro temperatures remained stable throughout the flight, with the following deviations from the buoyancy temperature at launch:

Roll/Azimuth	(602)	-0.31°C
Pitch	(601)	0.00°C

The binnacle heater signal indicated full "On" from liftoff through 13 seconds and then went off until 90 seconds. Between 90 and 103 seconds the signal gradually changed to "On" and remained "On" until 150 seconds. From 150 seconds through 220 seconds the signal made several excursions from "Off" to "On" and finally settled in the "Off" position.

Accelerometer scale factors measured during the pre-count and countdown were as follows:

X	Y	Z
2.00010	1.99927	1.999849

These values were consistent with previous measurements.

Computer

Computer operation was satisfactory throughout powered flight. BCO discrete and Yaw Steering were properly issued. The missile did not respond to the Yaw Steering Command due to lack of thrust at guidance steering enable.

Data Checker tests of the Range tape recorded during the first GAP Test had noise in the digital data. The Data Checker error count was just below the maximum allowable. The second GAP Test telemetry was clean and acceptable. Telemetry monitored just prior to launch was satisfactory.

Computer voltages were normal. Computer temperature rose from 30°C to 39°C.

Alignment Countdown Set

The Alignment Countdown Set (A-CS) operation was satisfactory. Accelerometer zeros were within the specified tolerances before launch, as measured with the A-CS, indicating proper operation of the zeroing loops.

Function	Nominal	Computed	Measured	Error
X offset	0.667	0.698483	0.698655	+0.00017
X zero	1.000	-	0.99913	-0.00087
Y zero	1.000	-	0.99693	-0.00307
Z zero	65.25407	65.20562	65.20688	+0.00126

Instrumentation

All channels of the Analog Signal Converter (ASC) operated satisfactorily. ASC temperature remained constant at 13°C throughout the flight.

The Digital Signal Converter performance was satisfactory.

Telemetry quality on this flight was good, with the normal dropout due to booster separation. After 300 seconds, Telemetry RF No. 1 reference voltages became erratic, causing periods of invalid data.

MOD III RANGE SAFETY AND INSTRUMENTATION SYSTEM

Performance of the Mod III Instrumentation and Range Safety System was satisfactory. The Mod III Tracker was coninuously locked from liftoff until approximately 164 seconds. The Rate Subsystem was continuously locked from 39.7 seconds until 154.5 seconds except for the normal signal loss at booster section separation.

The Mod III position and rate data provided to the Computer were considered to be of good quality. Continuous instrumentation data were provided to the Computer from 39.7 seconds to 154.5 seconds except for the brief interval at booster section separation.

A valid and uninterrupted IIP plot was presented to the Range Safety Officer from liftoff until approximately 155 seconds when the Computer went into its first period of "dead-reckoning". The Computer returned to STANDBY at 354 seconds.

The Mod III System was primary source for generation of the ASCO discrete; however, the discrete was not generated due to premature flight termination. The ASCO Inhibit Switch remained in the "Off" position for the entire flight.

This was the first "E" Series flight using the new "twisted" missileborne antenna. This type antenna was previously flown on Missile 2F.

Performance of the individual subsystems was as follows:

Track Subsystem

Track Subsystem performance was satisfactory. At liftoff the Mod III Track Subsystem was locked in automatic monopulse mode as planned and tracking was continuous through the booster phase. During this period the track received signal level averaged -48 dbm. The azimuth and elevation tracking errors averaged 0.07 mils peak to peak.

Approximately four seconds after staging the track received signal level began slowly to roll-off, reaching noise level at 164 seconds. Thereafter, periodic variations of signal amplitude caused several short intervals of monopulse memory and loss of lock. Final loss of signal and track lock occurred at 450 seconds.

The first attempt to re-acquire the missile by sixth cube at a point beyond range ambiguity was prevented by early termination of flight.

Rate Subsystem

Performance of the Rate Subsystem was satisfactory. All rate functions were locked at 10.8 seconds; however, due to a noisy received signal, intermittent bad lateral flags were recorded until 39.7 seconds.

Excluding the brief period of signal loss at booster section separation, continuous rate data was provided to the Computer from 39.7 seconds to 154.5 seconds. The average received signal during booster phase was -77 dbm.

Immediately after staging missile thrust decay was evidenced by decreasing range rate. At 130 seconds there was a velocity difference from the nominal of 59 feet per second. Twenty seconds later the magnitude of this difference had increased to 920 feet per second. In conjunction with sustainer thrust decay the rate signal began a slow roll-off reaching noise level at 154.5 seconds. Thereafter, signal variations, indicative of missile attitude changes, intermittently caused periods of rate unlock. Final loss of signal occurred at 427.6 seconds.

The parallax corrector was used on this flight, and the extended east rate leg redundant data was recorded.

Mod III Computer

The Computer operated satisfactorily during the countdown and ensuing flight with no malfunctions observed. The Range Safety and Instrumentation Program was entered upon reception of the Inertial Mode Start pulse at 2042:20.928 EST. The simulated re-run was made and revealed that no Computer transient errors occurred during the flight.

A mean calculation based on the last period of good data places the impact point at 71° 18.6' West Longitude and 25° 28.3' North Latitude at a range of approximately 575 nautical miles from Cape Canaveral.

RE-ENTRY VEHICLE

Missile 26E launched a Mark 4 Mod 2A Re-entry Vehicle containing a Sandia flight test warhead.

The C-band beacon and the telemetry systems operated satisfactorily throughout the flight. The premature termination and short trajectory precluded the realization of most of the flight test objectives pertaining to the re-entry vehicle.

The following is a chronology of available re-entry vehicle in-flight events.

Function	Time
Range Zero	0
Lockout Switch No. 1	72.2
Lockout Switch No. 2	83.4
Guidance Pre-arm	320.4
Arm Safe No. 1	320.5
Arm Safe No. 2	320.5
PSA Battery No. 1	321
PSA Battery No. 2	321
Separation	321.5

Loss of Signal (Station 3) occurred at T/ 475 .

PROPELLANT UTILIZATION

Performance of the Acoustica Propellant Utilization (PU) System was satisfactory. The first four sensor stations uncovered during powered flight. PU valve response to the error counter output signal was correct at all four stations, and the HS valve response to the PU valve movements was also correct throughout powered flight. The system utilized a 5 card computer.

At sustainer shutdown, Measurement U 113 V, Acoustica PU Valve Position Feedback Voltage, indicated the PU valve went to the full closed position while P 830 D, PU Valve Position, indicated that the PU valve went full open. However, since P 830 D showed an incorrect PU valve position earlier in flight, it is believed that P 830 D data is invalid after shutdown. The HS valve went full open at sustainer engine shutdown.

The following constants were applicable on Missile 26E.

Computer Type	CA 108B (5 card)
Computer Serial Number	0113
Valve Open Limit	45.0 degrees
Valve Nominal Angle	27.6 decrees
Valve Closed Limit	21.3 degrees

A tabulation of the powered flight sensor uncovering times, error times, and valve angle position just after sensor uncovering at each station is presented below.

Station	Fuel * Sensor Uncovering	LO2 * Sensor Uncovering	Error Time	PU Valve Angle Feedback Data
1	6.485	8.445	1.96	21.3
2	45.890	47.543	1.65	21.3
3	84.071	86.075	2.00	21.3

Station	Fuel * Sensor Uncovering	LO2 * Sensor Uncovering	Error Time	PU Valve Angle Feedback Data
4	115.811	117.515	1.70	23.0

* $\pm$ 0.025 seconds

PROPELLANT TANKING

Fuel was tanked on X-2 Day, 6 September 1961, to the overfill PLCU probe and secured. 45 gallons of fuel were topped on X-Day, returning the fuel level to the overfill PLCU probe at Sequence I Pressure. The level was then lowered until the overfill PLCU probe light de-activated. This topping was necessitated by an apparent density shift of /0.20 lbs/ft^3. At ignition the approximate fuel weight was 75,750 pounds as calculated by volume and density.

Density Data

Degree API	43.65
Temperature	90.0 °F
Density (X-2 Day)	49.60 lbs/ft^3
Density (Ignition)	49.80 lbs/ft^3

LO2 was tanked at a rapid fill rate to the 95 per cent PLCU probe. Tanking was continued at restricted flow until activation of the LO2 Topping High Probe. The first topping high probe activation was apparently premature causing a timer cutoff abort of the first slug transfer. The count was recycled and a second slug was initiated. The second slug attempt was successfully completed in 43.4 seconds.

During the second slug transfer the slug discharge pressure reached a high of 260 psig and decreased to 247 psig at slug complete.

At umbilical eject the 100 per cent slug cutoff probe was still activated, suggesting that the LO2 level at ignition was at least 850 pounds above the 100 per cent slug cutoff probe or that the probe did not react to the level drop associated with propellant consumption.

At ignition the LO2 density was 70.43 lbs/ft^3. This resulted in an approximate LO2 weight of 175,100 pounds, based on LO2 density and tank volume.

Weather Data

	Fuel Tanking	Ignition
Pressure	29.860 Inches of Hg	29.990 Inches of Hg
Temperature	84.30 °F	78.10 °F
Humidity	71.0 per cent	90.0 per cent
Wind	8.0 knots - E.SE.	5.0 knots - E.SE.
Total Cloud Cover	3/10	1/10

AIRFRAME INTERNAL INSTRUMENTATION

The Telemetry System provided data until well after 350 seconds.

Cape telemetry data indicated a 0.45 second dropout of all three RF's at staging. Station 3 telemetry experienced a dropout of approximately 0.3 seconds on RF Nos. 2 and 3. RF No. 1 data were not obtained from Station 3 due to a ground station difficulty. Interference was again noted on RF No. 1, Channel A from RF No. 1, Channel C. However, it was slight and did not interfere with obtaining data from Channel A. At 307 seconds telemetry power supply No. 1, monitored on RF No. 1, Channel A, Segment 25, began to vary. At 320 seconds Segment 25 dropped to zero per cent and remained there until 380 seconds. At 380 seconds RF No. 1, Channel A, Segment 25, increased but not to full voltage level.

There were four measurements that did not yield valid data.

S 223 D	V2 Pitch	Remained at zero - Deleted prior to launch.
P 39 P	B1 Fuel Pump Disch	Remained at zero - Deleted during countdown.
F 247 T	B Tank He Bottles	Remained above 100 per cent.
F 1 P	LO2 Tank Helium	Remained at 50 per cent.
P 830 D	PU Valve Position	Erratic between zero and 19 seconds and apparently gave false indication after booster jettison.

Missile 26E contained three Bendix Mod 7 FM Telemetry Packages. Basic telemetry channel assignment is given in Astronautics Report AZC-27-059-26. Included in that report are channel assignment, commutation information, frequency response, and make and model of transducer.

LANDLINE INSTRUMENTATION

The Landline Instrumentation System provided satisfactory data prior to lift-off. There were no discrepancies noted in the Brown or Esterline-Angus strip chart recordings.

Trailing wire umbilical instrumentation was added to this missile for purposes of evaluating certain propulsion system parameters. Data were obtained, as planned, for approximately 50 feet of missile rise. Ten of eleven measurements provided data. One measurement was unsatisfactory; Measurement P 1003 P, B2 LO2 Pump Inlet, was out of band on the high side.

Missile Aft-end Motion Determination

Satisfactory data were obtained from two aft lights and the top light. Film review reports indicate the third aft light was not visible. The cause of this is not known at this time; however, it may have been due to a bad lamp.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. The flight was unsuccessful.

2. The sustainer engine shut down during staging. From analysis of available data it appears that a failure accurred in the sustainer fuel system.

3. The critical period of sustainer shutdown occurred during the usual staging dropout of telemetry.

Recommendations

1. Add instrumentation to allow more thorough determination of sustainer engine operation.

2. Provide means to circumvent the dropout in telemetry at staging.

COUNTDOWN TIME VERSUS EVENTS

This test was a scheduled 150 minute countdown. The count was started on time at 1800 EST. There were three holds of 7 minutes total duration with recycles accounting for 4 minutes delay. Planned momentary holds at -1:35 and -60 seconds added another minute and total countdown time was 162 minutes. The holds were as follows:

1. At -2 minutes 17 seconds (2028 EST) with a recycle to -3 minutes 30 seconds for 2 minutes. There was no 18 inch water line pressure, as the pump was not turned on. After the pump was turned on, proper water line pressure was obtained, and the count was resumed at 2030 EST.

2. At -60 seconds (2033 EST) with a recycle to -3 minutes 30 seconds for 5 minutes. The slug transfer high topping indication was premature starting the 50 seconds slug duration timer early. As a result the timer expired before the slug was complete. The hold was required to allow time for preparation for a second slug attempt. The count was resumed at -3 minutes 30 seconds.

3. At -2 minutes 15 seconds (2039 EST) momentarily. Telemetry reported a low indication on the B1 Fuel Pump Discharge Pressure. The decision was made to delete the measurement and continue the count.

No further holds were required and the countdown was completed as planned.

The following notations were made by an observer in the blockhouse.

EST	Countdown Time	Countdown Procedure	Event
1800	T-150	T-150	Countdown Started.
			Started Telemetry Warm Up.
			Started Guidance Computer Warm Up.
1805	T-145	T-145	Telemetry Batteries Activated.
1806	T-144	T-144	GAP Test Started.
1814	T-136		GAP Test Completed Satisfactorily.
1816	T-134	T-135	Started Range Safety Command Test.
1818	T-132	T-135	Nose Cone Telemetry and Beacon to Internal.

EST	Countdown Time	Countdown Procedure	Event
1825	T-125	T-125	Range Safety Command Test Completed.
			Start Electrical Connection of Red Destruct Box.
1835	T-115		Rod Destruct Box and Retro-Rocket Installation Completed.
1839	T-111	T-105	Ready for Removal of AIGS Landline Umbilicals.
1850	T-100	T-100	Started Flight Control Systems Test.
1900	T-90		Flight Control System Test Completed.
1905	T-85		Slight Problem Moving Tower-One Floor Scraped Pod I Nose Fairing Causing Negligible Damage. Also a Cable Got Caught on One of the Floors.
1920	T-70	T-85	Started Helium Storage Preparations.
1923	T-67	T-55	GAP Test Preparations Started.
1925	T-65	T-65	Started Mod III Beacon Checks.
1926	T-64	T-55	GAP Test Started.
1932	T-58		GAP Test Completed Satisfactorily.
			Noise on ARMA Ground Station Data.
1934	T-56	T-65	Started Landline Calibrations.
1939	T-51	T-50	Secured GN2 Topping Gear.
1945	T-45	T-45	Started LO2 Tanking Preparations.
1948	T-42		Landline Calibrations Completed.
1950	T-40		Mod III Lockin Test Completed.
1953	T-37	T-35	LO2 Tanking Started.
2000	T-30	T-30	Started Flight Control Final Check.

EST	Countdown Time	Countdown Procedure	Event
2001	T-29		All Camera Coverage is 100 Per Cent Except Stations 6.1 and 7.1 Which Are 0 Per Cent.
2005	T-25	T-25	Range Ready for Azusa and RSC Final Checks.
2007	T-23	T-23	Azusa Check Started.
2008	T-22	T-22	Started Range Safety Command Final Test.
2010	T-20	T-20	Started Telemetry Final Warm Up.
2016	T-14	T-13	Azusa Check Completed.
2020	T-10	T-10	Started Telemetry/Range Safety Command AGC Check.
			Started Final Response Checks on Acoustica PU.
2021	T-9		Range Safety Command Final Check Completed.
2022	T-8		Flight Control Final Test Completed - Ready Light Is On.
2022	T-8		Acoustica PU Ready Light On.
2023	T-7	T-7	Final Range Clearance.
			Started Guidance Final Checks.
2025	T-5	T-5	Status Check - All "Go".
2025	T-4:30	T-4:30	Squibs Disarm Switch to "Off".
2026	T-3:50	T-3:50	Status Check - All "Go".
2027	T-3:30	T-3:30	T-3:30 And Counting.
			Telemetry to Internal.
2027	T-3:00	T-3:00	Timer Off - Ready Switch to Ready.

EST	Countdown Time	Countdown Procedure	Event
2028	T-2:17H	T-2:17	Holding - No 18 Inch Water Line Pressure.
			Recycle to T-3:30.
2030	T-3:30H	T-3:30	Status Check - All "Go".
2031	T-3:30	T-3:30	Resume Count. Telemetry to Internal.
2031	T-3:00	T-3:00	Timer Off - Ready Switch to Ready.
2031	T-2:45	T-2:45	Shut Down Power Switch to Arm.
2032	T-2:05	T-2:05	Commands to Internal.
2032	T-2:00	T-2:00	Nose Cone Beacon and Telemetry to Internal.
2032	T-1:55	T-1:55	Autopilot to Arm.
2032	T-1:50	T-1:50	Turning Water Systems On.
2032	T-1:45	T-1.45	Commands to Arm.
2032	T-1:40	T-1:40	Range Ready Switch "On".
2032	T-1:35	T-1:35	T-1:35 And Holding Momentarily - All Pre-Start Lights are Green - Slug Start.
			T-1:35 And Counting.
			Proceeding to Flight Pressurisation.
2033	T-1:10	T-1:10	Missile to Internal Power.
2033	T-1:05	T-1:05	Missile Helium to Internal.
2033	T-0:60	T-0:60	Holding - Recycle to T-3:30; 50 Second Slug Duration Timer Ran Out Before Slug Complete Light On; Topping High Came On too Early.

EST	Countdown Time	Countdown Procedure	Event
2037	T-3:30H	T-3:30	Status Check - All "Go".
2038	T-3:30	T-3:30	T-3:30 And Counting - Telemetry to Internal.
2038	T-3:00	T-3:00	Timer Off - Ready Switch to Ready.
2038	T-2:45	T-2:45	Shut Down Power Switch to Arm.
2039	T-2:15H	T-2:15	Holding - Telemetry Has Low Indication on B! Fuel Pump Discharge.
2040	T-2:15	T-2:15	Resume Count.
2040	T-2:05	T-2:05	Commands to Internal.
2040	T-2:00		Nose Cone Beacon and Telemetry to Internal.
			Nose Cone to Ready.
2040	T-1:55	T-1:55	Autopilot to Arm.
2040	T-1:50	T-1:50	Turning Water System "On".
2040	T-1:45	T-1:45	Commands to Arm.
2040	T-1:40	T-1:40	Range Ready Switch "On".
2040	T-1:35	T-1:35	T-1:35 and Holding Momentarily - All Pre-Start Lights Are Green - Slug Start.
			T-1:35 And Counting.
			Proceeding to Flight Pressurization.
2041	T-1:10	T-1:10	Missile to Internal Power.
2041	T-1:05	T-1:05	Missile Helium to Internal.
2041	T-0:60	T-0:60	T-60 Seconds and Holding Momentarily.

EST	Countdown Time	Countdown Procedure	Event
			T-60 Seconds and Counting.
	T-0:50	T-0:50	Water Full Flow.
	T-0:35	T-0:35	Status Check - All "Go".
2042	T-0:20	T-0:20	All Launch Commit Lights Are Correct.
2042	T-0:05	T-0:05	T-5 Seconds and Holding Momentarily.
			All Recorders to Fast.
			T-5 Seconds and Counting.
2042	T-0:01	T-0:01	Ignition Started.
2042:27.10			Range Zero.

MISSILE CONFIGURATION

Airframe

The SM-65E Missile is approximately 71 feet long from the re-entry vehicle interface to the aft surface of the thrust chambers. The missile structure is comprised of the booster structure and the main propellant tank structure. With the re-entry vehicle attached, the complete missile is approximately 81 feet long.

Azusa System

Type B-1A coherent carrier transponder in conjunction with the Mark II Ground Station. Utilised a tripod-mounted, elliptical horn antenna mounted in missile Quad IV.

Electrical System

Remotely activated, primary type, Eagle-Picher main missile battery and Leland rotary inverter.

Flight Control System

Square canister configuration with forward rate gyro canister containing pitch and yaw rate gyros. This was the first flight using the 27-41000-837 Servo Canister. The -837 Servo Canister was functionally the same as the 27-41000-831 Servo Canister previously flown on Missile 2F but incorporated changes to certain transistors (manufacturer only) as well as increased wattage ratings of some resistors. This was the first "E" Series flight and the second flight using the 27-45202-801 Gyro Canister and the 27-45045-5 Forward Rate Gyro Canister which incorporated the Spin Motor Rotation Detector (SMRD) System (previously flown on Missile 2F). This was the second "E" Series flight using the 27-41001-931 Programmer Canister (previously flown on Missile 21E)

Guidance System

ARMA Lot IV Missile Guidance Set in conjuaction with Lot II_m Ground Equipment.

Hydraulics Systems

Comprised of three independent systems which provide hydraulic pressure for booster operation, sustainer/vernier operation, and a 25 cubic inch accumulator for vernier solo operation. Hydraulic tubing was of aluminum except that directly associated with the sustainer engine, which was of corrosion resistant steel.

Impact Predictors

Azusa System and Mod III Instrumentation and Range Safety System.

Pneumatic System

Basic Astronautics system of five shrouded main propellant tank pressurisation titanium helium bottles, and one unshrouded bottle for vernier solo propellant feed, and booster jettison. Utilized F and G fuel and LO2 tank pressurization regulators.

Propulsion System

Rocketdyne MA-3 Liquid Engine Propulsion System.

Propellant Utilization System

The Acoustica Propellant Utilization system was utilized on this missile. This system uses a 400 cps signal for excitation of the PU valve position feedback transducer and a 5-Card computer. No specific gravity biases were used.

Range Safety Command System

Standard system with two ARW-62 Receivers, a power and signal control unit, arming switch, and destruct package. Utilized two manually activated, secondary type, Yardney batteries.

Telemetry System

The three airframe telemetry canisters utilized individual remotely activated, primary type, Eagle-Picher batteries. Three airframe telemetry links operational at 227.7, 229.9, and 232.4 mc.

Optical Beacon System

Standard Optical Beacon System in conjunction with the Ballistic (BC-4) Camera facilities at Stations 3, 4, 5, 6, and 7. Activation was programmed to occur at SCO + 0.1 seconds. Utilized a remotely activated, primary type, Eagle-Picher battery.

Mod III Instrumentation and Range Safety System

Mod III E Instrumentation Beacon System in conjunction with the Mod III Ground System. This was the first "E" Series flight and the second flight using the new "twisted" missileborne antenna (Part No. 27136010-3) which was previously flown on Missile 2F. The antenna was mounted on the tripod boom in missile Quad IV. This antenna was tilted 12 degrees so that it was parallel to the missile roll axis and was also rotated so that the plane of the antenna was tangent to the missile at the 36 degree radius from the positive yaw axis.

Propellant Tanking

Astronautics "E" Series Propellant Tanking System incorporating four ultrasonic fuel sensors, four LO2/GO2 detectors, a Propellant Loading Control Unit (PLCU) in the blockhouse, and 200-400 gallon LO2 slug.

Re-entry Vehicle

Mark 4 Mod 2A Re-entry Vehicle contained a Sandia Warhead, a C-band radar beacon, non-ejectable four pound SOFAR bomb and a recoverable data cassette. The telemetry system utilized two links, 252.4 mc and 255.1 mc.

AFSWC Pod

Second Atlas flight test for the Air Force Special Weapons Center Phase III Pod.

HISTORY OF SM-65E MISSILE NO. 26E

Atlas Missile 26E arrived at AMR on 7 July 1961 and positioned in the South bay of Hangar "K" for a minimum of hangar checkout. On 7 August Missile 26E was transferred to Hangar "J" and weighed. Missile erection was accomplished on Complex 13 on 9 August 1961. Pre-flight testing was accomplished in accordance with planning documented in Report 61-0100, Flight Test Directive, Atlas Missile 26E.

Significant events concerning Missile 26E from arrival at AMR to launch are delineated below:

Date	Event
16 August 1961	Successful propellant tanking.
18 August 1961	Successful Flight Acceptance Composite Test.
23 August 1961	Successful FAC Test. Fuses monitoring retro-rocket firing did not blow and a hydraulic leak on Vernier Engine No. 2 were observed.
5 September 1961	Satisfactory FAC Test.
6 September 1961	Successful fuel tanking.
8 September 1961	Flight.

A brief description of significant difficulties encountered in system preparation and testing accomplished at AMR is as follows:

Landline Instrumentation

The transducers for Measurements P 1001 P and P 1002 P, B1 LO2 and Fuel Pump Inlet Pressures, were found to be bad during calibration tests. Both transducers were IR'd and replaced.

IR'd accelerometers and amplifiers for Measurements P 1208 O and P 1209 O, B1 and B2 LO2 Dome Acceleration, for no output. Transducers were replaced with matched sets.

During high pressure checks, Measurement F 1246 P, Booster Bottles Pressure, was intermittant at approximately 3000 psi. This transducer was IR'd and replaced with a recommendation for failure analysis. The analysis revealed no malfunction in the transducer. A thorough check was made of the associated harnesses revealing no discrepancies. During pre-readiness checks on X-2 Day, the wiper arm was discovered to be open. The transducer was again IR'd and replaced with no subsequent problems.

Missile Electrical

No significant problems were encountered.

Range Safety Command

During Range Safety Command System testing, the Safe and Arm functions of the test destruct unit could not be accomplished properly. This was due to a grounded wire in a control cable to the KH3 Relay Box. This was corrected and the RSC System Test was completed.

Azusa

On 25 August 1961 the Azusa Transponder Serial No. 731-0053 was removed from the missile and sent to San Diego for transistor checks. Transponder Serial No. 731-0026 was checked locally at Azusa Field Service and installed. During system test it was discovered that this transponder had excessive warm up time. After FACT the transponder was removed and Serial No. 731-0042 installed. The Azusa System Test was satisfactorily completed.

Strobe Optical Beacon

No significant problems were encountered.

Telemetry

During the FACT, 18 August 1961, a number of measurements were found to be in error, and were corrected in the following manner:

1. S 376 X, Vernier Cutoff, was not received from A/P. TPS 13-1396 revealed a grounded resistor in the circuitry. The resistor splice was replaced and S 376 X was functionally tested by TPS 13-1403.
2. M 32 X, Conax Valve Command, did not activate. TPS 13-1398 was written to trouble shoot circuitry. It was found that the RF No. 1 Canister, Serial No. 0862, modifications were not complete. The measurement operated properly on the backup canister Serial No. 9V16. RF No. 1, Serial No. 0862, modification was completed in the telemetry lab and the measurement was functionally tested by TPS 13-1403

3. During the battery fit check procedure, 27-93867-BK-1A, the Telemetry No. 3 Battery plug on Harness 27-61827-813 was found to be clocked 180° from normal position. This caused the backshell of the plug to be pointed forward instead of aft. The harness did not have sufficient length to permit installing with backshell pointing forward. IR 645346 written to add necessary length to install plug.

4. The performance of TPS 13-1370 disclosed a discrepancy in Measurement A 446 T. The measurement was reading negative indicating a lower than normal resistance for the measurement. TPS 13-1394, TPS 13-1424 and TPS 13-1433 were written to trouble shoot the circuitry. Pigtails on pins B and V of Plug 101U1P2 were grounded. This condition was corrected.

Flight Control

The gyro spin indicator light failed while LO2 tanking was in progress. An investigation revealed that excessive AC noise pick-up on the SMRD test wire caused the light to go off. The problem was eliminated by cutting and grounding the test wire.

Vernier No. 1 went hard over in minus yaw during vernier engine alignments. The yaw actuator was found to be inoperative and was replaced. The Vernier No. 1 Engine went to a minus 30° position. The Servo Canister was replaced eliminating the problem.

Mod III E Instrumentation Beacon

During the first pressure test, there was a waveguide leak caused by San Diego torque paint on an "O" Ring. The "O" Ring was replaced and the test completed satisfactorily.

During the first FACT, the MIBTS failed to interrogate the pulse beacon. Purging the tower waveguide eliminated the problem and during subsequent testing the system operated satisfactorily.

After heavy rains, the unpressurized teardrop fairing around the GE antenna was half full of water. This apparently entered through the support strut, around the waveguide. The fairing was drained and purged.

Hydraulics

During FACT, H 212 P, Vernier System Return Pressure, had no pressure indication. The cause was investigated and the sensing line was found to be connected to H 191 P, Sustainer High Pressure, instrumentation tee and H 191 P Sensing Line was connected to H212 P Instrumentation Tee. Over pressurization of H 212 P Transducer was the cause of the failure.

Vernier No. 2 Yaw Actuator 27-85312-805 (Modified Clemco) was replaced on X-2 Day when the shaft seals leaked. This resulted in additional Autopilot testing.

H 212 P Transducer developed hydraulic fluid leakage around the indexing pin and necessitated replacing twice after over pressurization of the first transducer.

Propellant Utilization

No significant problems were encountered.

Propulsion

Two V-2 engines were replaced due to excessive hydraulic fluid leakage past the gimbal shaft seals.

The B1 fuel staging valve was leaking between the -1 forward half and -3 aft half. The -1 forward half was .016 inches out of round. The -3 half was removed and the "O" ring was found twisted in the groove. Both valve halves were replaced

Complex Mechanical

During LN2 chill test, shroud leakage Quad III and Quad IV was observed. All joints in this area were coated with zinc-chromate paste and tape. Additional proof testing indicated full correction of all leaks.

During the launch operation at the time of the first slug transfer attempt the LO2 high topping probe failed. This failure prematurely started the 50 second timer and caused a slug transfer abort when timer ran out before 100 per cent completion was satisfied. A second attempt to deliver a slug was satisfactory.

Complex Electrical

During performance of PLCU procedure 27-90314-BK-1D it was found that 95 per cent LO2 Probe Connector 203U2J1 was incorrectly installed. IR No. 645342 was issued against this item and installation was corrected.

During second FAC Test performed on 23 August, Umbilical 600U3 did not electrically eject from the missile. Subsequent performance of umbilical eject solenoids operational checks pointed to a conclusion the seven adapters were hanging up mechanically and would not reliably eject. The rejected adapters were IR'd and replaced.

Propellant Loading

No significant problems were encountered.

Re-entry Vehicle

The nose and flare assemblies of the Mark 4 Mod 2A-4 were delivered at AMR on 13 April 1961. In the course of hangar checks, it was found necessary to replace the flight programmer and inertial switch. After minor modification and final systems tests, the re-entry vehicle was mated with Atlas Missile 26E on 22 August 1961

Airframe

The vernier fairings were modified to close the excessive gap around the engine gimbal housings to prevent Aerodynamic heating inside the fairings.

Pneumatics

During LO2 Tanking Test the first slug transfer resulted in excessive high LO2 pump inlet temperatures. A second slug was delivered with no alteration of parameters. All temperature data were normal during this slug. This observation is unexplained at this time.

Inertial Guidance

On 28 August 1961, an investigation of the optics equipment indicated a low gradient. All amplifiers were changed and checked. Indications were that the photocell output was low. Since a new photocell tube was not available, the Gradient Set Switch was changed to the 100 MV position from 50 MV position thus increasing the loop gain to compensate for the lowered gain of the photocell.

During the MGS System Test on 31 August 1961, the computer would not come on. Contacts 3 and 4 of Relay K7414 were open. The system was switched to Relay K7414, Contacts 6 and 7 and the computer came on. However, no discretes were observed during the computer problem.

On 1 September 1961 the investigation of the discrete problem was continued and the umbilicals were purged. There were still no discretes observed during the computer problem. Investigation revealed a short in Umbilical U7, J3K and the umbilical was changed. Computer results were then satisfactory.

During the MGS System Test on 2 September 1961, final alignment was reached, but roll pendulum output was very noisy. Investigation revealed that the roll pendulum output leads in the umbilical were shorted to ground. The umbilical was removed to be repaired.

On 4 September 1961 the repaired umbilical was installed and tested satisfactorily.

The bench mark air conditioning motor compressor unit was replaced on 7 September 1961. This unit had previously given trouble on 23 August 1961, when the temperature in the bench mark was up to 110°F giving erroneous readings on the optics unit.

APPENDIX

FLUID CHEMICAL ANALYSIS

	Unit	Sample A	Sample B	Specification
Liquid Oxygen				
Purity	Per cent	99.6		99.5 Minimum
Hydrocarbons				
As Methane	ppm	13		75.0 Total Maximum
As Acetylene	ppm	None		0.5 Maximum
Particle Count				
50 - 175	Microns	2		No solid particles greater than 175 microns. (Fibers not acceptable.)
175 +	Microns	1*		
Fibers		3		

* This item is out of specification.

Gaseous Helium				
Purity	Per cent	99.9+		99.9+ Minimum
Hydrocarbons	ppm	None		75.0 Total Maximum

This item is within specification.

Gaseous Nitrogen				
Purity	Per cent	99.6		99.5 Minimum
Hydrocarbons	ppm	None		75.0 Total Maximum

This item is within specification.

Lubricating Oil				
Viscosity at 100°F	Centistokes	12.6		23.0 to 34.0
Viscosity at 210°F	Centistokes	3.3		
Flash Point	°F	440		280.0 Minimum
Viscosity Index		129.5		80.0 Minimum

This item is within specification.

	Unit	Sample A	Sample B	Specification
Trichloroethylene				
Appearance		Pass		Clear and Free
Color		Faint Yellow Cast		Not Red, Blue, Green, or Purple Dyed.
Odor		Characteristic		
Specific Gravity	@68°/68°F	1.460		1.454 to 1.476
Distillation	°C	86.5-87.4		85.0 to 91.3
Water Content	@14.0°F	Pass		Cloudless
Non-volatile	Per cent	.0004		0.002 Maximum
This item is within specification.				
Fuel, RP-1				
Initial Boiling	°F	361	365	Report
10 Per cent	°F	390	396	364-410
50 Per cent	°F	419	424	Report
90 Per cent	°F	450	456	Report
End Point	°F	472	488	525 Maximum
Residue	Per cent	1.0	0.9	1.5 Maximum
Loss	Per cent	0.1	0.1	1.5 Maximum
Flash Point	°F	144	143	110 Minimum
Gravity	°API	43.6	43.65	42.0 to 45.0
Particle Count				
10 - 20	Microns	2,400	7,800	No solid particles
20 - 40	Microns	720	3,600	greater than 175
40 - 80	Microns	120	720	microns. (Fibers
175/	Microns	0	2*	not defined.)
Moisture Content		None	None	
Fiber Count	Microns	4	10	

Sample A: This item is within specification.
* Sample B: This item is out of specification.

	Unit	Sample A	Sample B	Specification
Hydraulic Fluid - Booster				
Flash Point	°F	212		200.0 Minimum
Color		Clear		
Viscosity	Centistokes	8.9		8.5 Minimum
Dye		Red		
Particle Count				
10 - 25	Microns	3,600		5,500 Maximum
26 - 50	Microns	900		2,400 Maximum
51 - 100	Microns	60		300 Maximum
Over 100	Microns	5		20 Maximum
Fibers	Microns	7		20 Maximum

This item is within specification.

Hydraulic Fluid - Sustainer				
Flash Point	°F	210		200.0 Minimum
Color		Clear		
Viscosity	Centistokes	8.8		8.5 Minimum
Dye		Red		
Particle Count				
10 - 25	Microns	5,160		5,500 Maximum
26 - 50	Microns	2,100		2,400 Maximum
51 - 100	Microns	240		300 Maximum
Over 100	Microns	7		20 Maximum
Fibers	Microns	7		20 Maximum

This item is within specification.

REFERENCE DOCUMENTS

Flight Test Plan - Missile No. 26E	AE 60-0800
Flight Test Program - SM-65 Series E, R & D Missiles	AZC-27-005
Detailed Test Requirements (AFBMD/STL)	STL/OR-60-0000-19028
Flight Test Directive (FTWG)	AA 61-0100

Additional reports which may be referenced for further information regarding this missile are listed below:

Reports	Approximate Issue Date (time after test)
Acoustica Associates, Inc., Los Angeles, Calif.	
Flight Test Evaluation Report	30 days
General Dynamics/Astronautics, San Diego, Calif.	
Flight Test Evaluation Report	14 days
ABMD/STL, Inglewood, Calif.	
Flight Summary Report	8 - 12 weeks
ARMA, CCO	
CCO Quick Look Report	7 - 10 days
American Bosch ARMA Co., Garden City, N. Y.	
Flight Test Evaluation Report	30 days
AVCO, Wilmington, Mass.	
Final Flight Report	30 days
General Electric, Syracuse, N. Y.	
Evaluation Report of Mod III Instrumentation System with Missile 26E	6 - 10 weeks

SERIAL NUMBERS OF SYSTEM COMPONENTS

AZUSA TRANSPONDER, Serial No. 731-0071

RE-ENTRY VEHICLE, Mark 4, Mod 2A-4, Serial No. L-25599

RANGE SAFETY COMMAND SYSTEM

Range Safety Command Receiver, Serial No. AF60-55
Range Safety Command Receiver, Serial No. AF58-100
Range Safety Command Receiver No. 1, Battery, Serial No. 010-0479
Range Safety Command Receiver No. 2, Battery, Serial No. 010-0478
Range Safety Command Power and Signal Control Unit, Serial No. 012-0042
Destruct Package, Serial No. 103-0136
Range Safety Command Arming Switch, Serial No. 009-0028

PROPULSION SYSTEM

Sustainer, Serial No. 222732
Booster No. 1, Serial No. 112765
Booster No. 2, Serial No. 112782
Vernier No. 1, Serial No. 332766
Vernier No. 2, Serial No. 332764

ELECTRICAL SYSTEM

Main Missile Battery, Serial No. 106-0445
Inverter, Serial No. 002-0057
Power Changeover Switch, Serial No. 103-0104

MOD III E INSTRUMENTATION BEACON SYSTEM

Rate Beacon, Serial No. 6E9015
Pulse Beacon, Serial No. 6E1027

TELEMETRY SYSTEM

Telemeter RF No. 1, Serial No. 011-0001
Telemeter RF No. 2, Serial No. (No Serial No.) 0745 (Mfg. Serial No.)
Telemeter RF No. 3, Serial No. 011-0006
Telemeter RF No. 1, Battery, Serial No. 102-0538
Telemeter RF No. 2, Battery, Serial No. 102-0547
Telemeter RF No. 3, Battery, Serial No. 102-0544
Accessory Package, Serial No. 103-0016

FLIGHT CONTROL SYSTEM

Gyro Canister, Serial No. 106-0163 (229)
Forward Rate Gyro Canister, Serial No. 107-0072 (72)
Servo Canister, Serial No. 102-0001 (222)
Programmer, Serial No. 011-0057 (216)

PROPELLANT UTILIZATION SYSTEM

Canister, ACA-0113

PNEUMATICS SYSTEM

LO2 Tank Pressure Regulator, Mfg. F & G, Serial No. 902-0289
Fuel Tank Pressure Regulator, Mfg. F & G, Serial No. 902-0309

INERTIAL GUIDANCE SYSTEM

Platform, Serial No. 7210031
Control, Serial No. 7220006
Computer, Serial No. 7230053
Analog Signal Converter, Serial No. 019
Digital Signal Converter, Serial No. 7140034

OPTICAL BEACON SYSTEM

Unit, Serial No. 011-0038
Battery, Serial No. 010-0076

SIGNIFICANT DATES DURING TESTING OF "A" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
4A	12-8-56	14	3-22-57	6-3-57	6-11-57	895	Engine shut down at 29.9 seconds of flight. Missile destroyed at 50.1 seconds.
6A	6-6-57	14	8-2-57	9-20-57	9-25-57	1422	Engine shut down at 47.7 seconds of flight. Missile destroyed at 74 seconds.
12A	11-1-57	14	11-20-57	12-11-57	12-17-57	2140	Successful flight. Impacted approximately 490 nm downrange.
10A	7-18-57	12	9-27-57 10-27-57 11-6-57	*11-27-57 **12-10-57 1-4-58	1-10-58	10	Successful flight. Impacted approximately 542 nm downrange.
13A	12-4-57	14	1-17-58	***1-31-58	2-7-58	222	Engine shut down prematurely at 117.8 seconds of flight due to flight control system failure. Missile broke up at 167 seconds.
11A	12-20-57	12	1-25-58	2-8-58	2-20-58	449	Engine shut down prematurely at 124 seconds of flight due to flight control system failure. Missile broke up at 126.5 seconds.
15A	1-6-58	14	2-26-58	3-22-58	4-5-58	634	Engine shut down prematurely at 105 seconds of flight due to B1 turbopump failure. Missile remained intact and impacted approximately 200 miles downrange.
16A	2-5-58	12	3-17-58	****5-16-58 5-22-58	6-3-58	1261	Successful flight. Impacted approximately 480 nm downrange.

* Premature cutoff at 6 seconds. Both booster chambers damaged, necessitating replacement.

** Full duration, but damaged B1 chamber, necessitating replacement.

*** FRF terminated prematurely, but considered satisfactory.

**** Prematurely terminated due to APS shutdown.

SIGNIFICANT DATES DURING TESTING OF "B" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
3B	4-12-58	11	5-29-58	*6-23-58 **6-27-58 7-8-58	***7-12-58 7-19-58	1564	Missile broke up at 42 seconds of flight. Due to failure of the yaw rate gyro.
4B	5-31-58	13	6-13-58	7-15-58	8-2-58	1382	Successful flight. Impacted approximately 2345 nm downrange.
5B	5-30-58	11	7-22-58	8-20-58	8-28-58	1383	Successful flight. Impacted approximately 2853 nm downrange. First completely closed loop guidance system flight.
8B	7-31-58	14	8-6-58	9-6-58	9-14-58	1511	Successful flight. Impacted approximately 3151 nm downrange.
6B	7-17-58	13	8-14-58	9-10-58	9-18-58	1512	B1 turbopump failed at 80.8 seconds after lift-off. Missile exploded two seconds later.
9B	8-7-58	11	9-12-58 ##9-30-58	#10-4-58 ###10-24-58 ####10-27-58	11-17-58	1513	Depletion of fuel supply caused simultaneous premature sustainer and vernier shutdown. Missile impacted 800 to 900 nm short of intended impact point. First flight of modified booster turbopumps.
12B	9-4-58	14	11-6-58	11-24-58	11-29-58	1730	Successful flight. Impacted approximately 5506 nm downrange.
10B	10-22-58	11	11-23-58	****12-9-58 ***12-10-58 12-12-58	12-18-58	1729	Successful flight. Missile placed into orbit.
13B	12-4-58	14	12-8-58	12-22-58	1-15-59	30	Flight prematurely terminated due to unexplained difficulties starting at 100 seconds after liftoff. Missile impacted 170 nm downrange. There was no telemetry system aboard this missile.
11B	8-22-58	11	12-23-58	1-20-59	2-4-59	29	Successful flight. Impacted approximately 3122 nm downrange.

* Automatic cutoff initiated by sustainer overspeed/underspeed trip 1.96 seconds after BOG links break.

** Automatic cutoff initiated by sustainer overspeed/underspeed trip 1.88 seconds after BOG links break.

*** Prematurely terminated by an automatic cutoff 4.98 seconds after BOG links break.

**** Vernier ignition only.

\# Manual cutoff at 6.69 seconds.

\#\# After installation of "C" Series power pack in Hangar "J".

\#\#\# Automatic cutoff initiated by sustainer overspeed/underspeed trip 1.0 seconds after BOG links break.

\#\#\#\# Full duration, but engine compartment fire delayed schedule approximately 10 days.

SIGNIFICANT DATES DURING TESTING OF "C" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
3C	10-31-58	12	11-4-58 *11-25-58	12-17-58	12-23-58	2501	Successful flight. Impacted approximately 3803 nm downrange.
4C	11-9-58	14	1-6-59	1-19-59	1-27-59	10	Although impact was close to intended point, the guidance system did not function.
5C	1-31-59	12	2-6-59	None	2-20-59	251	Missile exploded at 174 seconds due to a malfunction at staging. Probable cause was improper operation of the fuel staging valve.
7C	2-12-59	12	2-23-59	None	3-18-59	761	Booster engine shutdown prematurely at 131 seconds of flight. Missile was unstable for remainder of flight.
8C	5-7-59	14	5-11-59	**6-22-59 **7-9-59	‡7-15-59 7-21-59	4163	Successful flight. Impacted in target area 4385 nm downrange. RVX-2 Re-entry Vehicle recovered.
11C	7-15-59	14	7-25-59	8-14-59	8-24-59	2121	Successful flight. Impacted almost 5 miles long in MILS net due to residual thrust after vernier cutoff. Re-entry vehicle was recovered.

* After power pack modification.

** Two successful Flight Readiness Firings performed.

‡ Ignition achieved twice. Manual cutoff for 1st. attempt in vernier ignition phase. Second attempt terminated by release timer.

SIGNIFICANT DATES DURING TESTING OF "D" SERIES FLIGHT VEHICLE

Missile	Arrival	Complete	Erection	FRF	Flight	AMR Range No.	Comments
3D	2-25-59	13	2-27-59	3-27-59	4-16-59	1802	Booster section exploded 27 seconds after liftoff due to failure of airborne LO2 fill and drain valve to close. Missile destroyed at 37 seconds.
7D	3-20-59	14	4-13-59	5-8-59	*5-15-59 5-18-59	1754	Missile exploded at 65 seconds due to improper launcher operation which resulted in loss of fuel tank pressure.
9D	3-8-59	13	4-28-59	5-15-59	6-6-59	1753	Missile exploded at 160 seconds due to a malfunction at staging. Probable cause was improper operation of the fuel staging valve.
11D	4-10-59	11	5-11-59	**7-14-59 7-22-59	7-28-59	2002	Successful flight. Impacted 4384 nm downrange less than 1/2 mile from target in MILS net.
14D	5-7-59	13	6-10-59	7-28-59	8-11-59	2003	Successful flight. Impacted in MILS net less than 1 mile from target.
17D	5-27-59	13	8-17-59	9-9-59	9-16-59	2106	Successful flight. Impacted 2 miles short of target in MILS net due to failure of vernier solo hydraulic package.
18D	5-27-59	11	9-2-59	None	10-6-59	2120	Successful flight. Impacted in MILS net less than 1/2 mile from target.
22D	8-26-59	13	9-21-59	None	10-9-59	3505	Successful flight. Impacted in MILS net less than 1 1/2 miles from target.
24D	9-18-59	11	10-8-59	None	10-29-59	2344	Due to malfunction of V2 engine at staging, impacted approximately 14 miles short of target point.
28D	9-18-59	13	10-14-59	None	11-4-59	4203	Unsuccessful. A/B IP failure prevented Station 5 IP system from acquiring the missile. Range safety cutoff caused R/V to impact approximately 260 miles short of target.
15D	5-9-59	11 14 13	7-11-59 9-23-59 11-7-59	None	11-24-59	2105	Successful although re-entry vehicle did not seperate. Impacted in MILS net.
31D	10-10-59	13	11-28-59	None	12-8-59	4206	Successful flight. Impacted 1/2 mile from target in MILS net.

SIGNIFICANT DATES DURING TESTING OF "D" SERIES FLIGHT MISSILES AT AMR (Cont'd)

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
40D	11-30-59	13	12-10-59	None	12-18-59	16	Successful flight. Delivered a Mk-2 Re-entry Vehicle within 3 nm of target over a 5500 nm range.
42D	12-8-59	13	12-22-59	None	1-6-60	32	Successful flight. Delivered a Mk-3 Re-entry Vehicle within 3 miles of target over a 5500 nm range.
44D	12-17-60	13	1-11-60	None	1-26-60	54	Successful flight. RVX4-A2 Re-entry Vehicle impacted approximately 1/2 mile from target in MILS net.
49D	1-8-60	13	1-28-60	None	2-11-60	320	Successful flight. Mk-3 Re-entry Vehicle impacted less than 1 1/2 nm from target over a 5500 nm range.
43D	12-5-59	11	12-21-59	(2)2-4-60 2-23-60	(3)3-4-60 3-8-60	17	Successful flight. First missile to use all-inertial guidance system open loop.
51D	1-29-60	13	2-15-60	None	3-10-60	775	Destroyed by fire and explosion immediately after liftoff.
48D	3-19-60	11	3-18-60	None	4-7-60	301	Destroyed in the stand by fire and explosion during a launch attempt.
56D	3-3-60	12	4-11-60	None	(4)(5)5-12-60 5-20-60	1806	Successful flight. Delivered Mk-3 Re-entry Vehicle within 4 nm of target over an extended range of 7859 nm.
54D	2-23-60	11	5-13-60	None	6-11-60	615	Successful flight. Delivered Mk-3 Re-entry Vehicle 4306 nm downrange within 2.2 nm of target. First flight with AIG system providing active guidance functions.
62D	4-19-60	14	5-26-60	None	6-22-60	801	Impacted approximately 18 nm long due to failure of the vernier engines to shutdown when the guidance cutoff discrete was received.
27D	5-27-60	12	6-6-60	None	6-27-60	1002	Successful flight. Impacted within 1 nm of target in MILS net 4388 nm downrange.
64D	4-5-60	11	6-14-60	None	7-2-60	803	Inadvertent pressurizations of the engine tanks caused premature depletion of control helium. Re-entry vehicle impacted 40 nm short.
32D	6-22-60	12	7-1-60	None	(4)(5)(6)8-2-60 8-9-60	1003	Successful flight. Impacted within 4 nm of target in South Atlantic Ocean over the intermediate range of 6350 nm.

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SIGNIFICANT DATES DURING TESTING OF "D" SERIES FLIGHT MISSILES AT AMR (Cont'd)

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
64D	6-16-60	11	7-7-60	None	8-12-60	1004	Successfully impacted re-entry vehicle within 2 nm of target. First Atlas to use AIG system with impact programmed for Station 12 MILS net.
76D	7-6-60	11	8-15-60	None	9-16-60	2817	Successfully placed RVX-2A Re-entry Vehicle within 5 nm of target. Second Atlas to use AIG System with impact in Station 12 MILS net.
79D	7-13-60	14	8-26-60	None	***9-15-60 9-19-60	842	Successful flight. Second Atlas to deliver a Mark 3 Re-entry Vehicle to target over an extended range of 7863 nm.
71D	8-19-60	11	9-26-60	None	10-13-60	1502	Successful flight. Impacted within 2 nm of target 4387 nm downrange. Last D-AIG Missile to be flight tested. RVX-2A Re-entry Vehicle recovered.
56D	2-27-60	12	3-7-60 5-24-60 10-3-60	None	10-22-60	613	Successful flight. Impacted within 1 nm of target 6350 nm downrange. The missile was flown without insulation and insulation bulkhead at the intermediate bulkhead with no adverse results.
83D	10-6-60	12	10-27-60	None	11-15-60	3603	Successful flight. Impacted less than 1 nm from target 4386 nm downrange. Data cassette recovered.
90D	12-14-60	12	12-30-60	None	1-23-61	3506	Successful flight. Last of "D" Series Weapon System flights. Impacted Mk-3 Mod 1B Re-entry Vehicle within 1/2 nm of target 4394 nm downrange.

* Launch aborted due to faulty release timer which initiated automatic cutoff.

** Test terminated by sustainer rough combustion cutoff circuitry.

*** Launch aborted 5.48 seconds after sustainer flight lockin because no release signal was generated.

\# Recycle due to Guidance System difficulties.

\## Engine cutoff prior to release due to erroneous callout in blockhouse.

\### Terminated by erroneous output from B2 primary RCC accelerometer.

\#### Terminated 1.53 seconds after sustainer flight lockin by the sustainer RCC system.

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SIGNIFICANT DATES DURING TESTING OF "E" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
3E	8-19-60	13	7-29-60	*9-23-60 10-3-60	10-11-60	1908	Malfunction in sustainer hydraulic system caused loss of missile after staging.
4E	9-15-60	13	10-21-60	None	11-29-60	2000	Sustainer hydraulic pressure was lost at 41 seconds and caused missile to become unstable at booster cutoff. Sustainer thrust was lost at about 150 seconds.
8E	10-25-60	13	12-5-60	None	1-24-61	3504	Missile stability was not maintained after 161.0 seconds due to loss of engine servo control in flight control system. Sustainer engine shutdown at 249 seconds.
9E	11-11-60	13	1-30-61	None	2-24-61	3083	Successful flight. Impacted Mark 3 Mod II B Re-entry Vehicle within 600 yds. of aim point.
13E	1-13-61	13	2-27-61	None	3-13-61	403	Malfunction in PU system caused fuel depletion and premature shutdown of sustainer engine at 152 seconds.
16E	3-10-61	13	3-14-61	None	3-24-61	811	Failed to jettison the booster section because of premature depletion of engine control bottle helium pressure.
15E	12-30-60	11	2-16-61	None	5-12-61	404	Successful flight. Impacted Mark 5 Mod I Re-entry Vehicle within 0.5 mile of target at a range of 4388 miles. First "E" Series from Complex 11.
18E	3-30-61	13	4-8-61	None	5-26-61	813	Successful flight. Impacted Mark 4 Mod IV Re-entry Vehicle 1 mile of target at a range of 4388 nautical miles. First "E" Series missile flown without insulation and insulation bulkhead at the intermediate bulkhead with no adverse results.
17E	3-21-61	11	5-10-61	None	6-22-61	812	Unsuccessful flight. Malfunction in the Flight Control System caused loss of missile after 101 seconds.

* B2 lube oil pump shaft sheared. Test duration 14 seconds.

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SIGNIFICANT DATES DURING TESTING OF "E" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
22E	6-6-61	13	6-14-61	None	7-6-61	1251	First "E" Series missile to be successfully flown to a maximum range target of 7863 nautical miles with impact of 2.1 nautical miles of target.
21E	6-26-61	11	7-5-61	None	7-31-61	1360	Impacted a Mark 5 Mod I Re-entry Vehicle within 3.1 nautical miles of target at a range of 4388 nautical miles.

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SIGNIFICANT DATES DURING TESTING OF "F" SERIES FLIGHT MISSILES AT AMR

MISSILE	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
2F	7-2-61	13	7-12-61	None	8-8-61	1006	First "F" Series Missile to be flight tested. Impacted Mark 5 Mod I Re-entry Vehicle 4308 nautical miles within 2.1 nautical miles of aim point.

SIGNIFICANT DATES DURING TESTING OF MERCURY/ATLAS VEHICLES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
10D	6-10-59	14	6-2-59 *7-22-59	9-3-59	9-9-59	2119	Successful flight although booster section failed to jettison. Project Mercury Capsule recovered.
50D	5-17-60	14	6-30-60	7-21-60	7-29-60	1505	Unsuccessful. Missile apparently destroyed after 60 seconds of flight. Mercury Capsule remained intact until impact.
67D	7-8-60	14	11-4-60	11-19-60	2-21-61	419	Successful MA-2 mission. Impacted Mercury Capsule as planned. First closed loop flight for ASIS. Capsule recovered.
100D	3-14-61	14	3-27-61	None	4-25-61	835	Unsuccessful. Missile was destroyed by range safety action 40 seconds after lift-off. This action was necessitated by the absence of the roll and pitch-over maneuvers.

* Returned to hangar for booster power package replacement.

SIGNIFICANT DATES DURING TESTING OF MIDAS VEHICLES AT AMR

Missile	Arrived	Complete	Erection	FLT	Flight	AMR Range No.	Comments
203	10-18-59	14	1-19-60	None	2-26-60	306	MIDAS I Booster shot. Atlas portion of flight was successful.
403	1-25-60	14	3-3-60	None	5-24-60	619	MIDAS II Booster shot. Atlas portion of flight completely successful.

SIGNIFICANT DATES DURING TESTING OF ATLAS/ABLE LUNAR PROBES AT AMR

Missile	Assigned	Shipping Requested	Received	ETR	Flight	AMR Report No.	Comments
9C	6-1-59	12	6-15-59 (6-17-59	9-30-59		3044	Destroyed by fire and explosion following premature cutoff during flight conditions Range.
10	9-10-59	14	10-19-59	Blue	11-26-59	4122	Atlas/Able IV Lunar Probe. Atlas portion of flight was successful. Premature of Able fueled at 47 seconds.
8D	9-15-60	12	9-2-60	Blue	9-25-60	3901	Atlas/Able V Lunar Probe. Atlas portion of flight was successful. Second stage engine operation unsatisfactory.
9D	10-15-60	12	11-17-60	Blue	12-15-60	4045	Unsuccessful. Flight was terminated after 74.5 seconds when the vehicle destroyed itself.

Erected twice due to cancellation of test and subsequent return to hangar for storage.

END

DATE

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